



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001**

September 28, 2001

**MEMORANDUM TO:** C. William Reamer, Chief  
High-Level Waste Branch  
Division of Waste Management  
Office of Nuclear Material Safety and Safeguards

**FROM:** William L. Belke, Sr. On-Site Licensing Representative  
Repository Site Section  
Division of Waste Management  
Office of Nuclear Material Safety and Safeguards

Robert M. Latta, Sr. On-Site Licensing Representative  
Repository Site Section  
Division of Waste Management  
Office of Nuclear Material Safety and Safeguards

**SUBJECT** U.S. NUCLEAR REGULATORY COMMISSION ON-SITE  
LICENSING REPRESENTATIVES' REPORT ON YUCCA  
MOUNTAIN PROJECT FOR JULY 1, 2001 THROUGH AUGUST  
31, 2001

The purpose of this letter is to transmit the U.S. Nuclear Regulatory Commission (NRC) On-Site Representatives' (OR's) report for the period of July 1, 2001, through August 31, 2001.

This report highlights a number of Yucca Mountain Project activities of potential interest to NRC staff. The OR's continue to respond to requests from NRC Headquarters staff to provide various documentation and feedback related to Key Technical Issues (KTI's) and their resolution. During this reporting period, the OR's continued to observe activities associated with Yucca Mountain Site Characterization, KTI's, and auditing. The OR's also attended a number of meetings and accompanied NRC staff on visits to Yucca Mountain.

If you have any questions on this report or its enclosures, please call William L. Belke on (702) 794-5047, or Robert M. Latta on (702) 794-5048.

**Enclosures:** U.S. Nuclear Regulatory Commission On-Site Licensing Representatives' Report  
ESF/ECRB Plan View Alcove, Niche and Borehole Test Locations  
Nye County Early Warning Drilling Program Drillhole Locations  
ATC Site Layout/ATC Cross-hole Configuration

Distribution list for Memorandum to C.William Reamer, dated: September 28, 2001

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U.S. NUCLEAR REGULATORY COMMISSION  
ON-SITE LICENSING REPRESENTATIVES' REPORT  
NUMBER OR-04-01

FOR THE REPORTING PERIOD OF JULY 1, 2001 THROUGH AUGUST 31, 2001

/s/  
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William L. Belke  
Sr. On-Site Licensing Representative  
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Enclosures

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## **1.0 EXECUTIVE SUMMARY**

### **QUALITY ASSURANCE, ENGINEERING, AND NRC KEY TECHNICAL ISSUES**

#### **DEFICIENCIES DATA BASE**

In the last On-Site Representative's (OR) report, the OR review of the data base used for tracking deficiencies adverse to quality revealed that there may be areas where there are recurrences of deficiencies that were previously identified and closed. One area of a suspected trend was the recurrence of scientific notebook (S/N) deficiencies. These increased deficiencies prompted the U.S. Department of Energy (DOE) Office of Quality Assurance (OQA) to issue a Suspected Trend Investigation Report (STIR). The STIR resulted in an OQA surveillance which concluded that Bechtel SAIC Company, LLC is pro-active in the control of S/N's and that no adverse quality trend exists. Although the review did not indicate there was a significant condition adverse to quality, OQA initiated an effort to review subsequent documentation generated on deficiencies associated with S/N's. This review is due to be completed the last week of September 2001.

#### **DOE QA AUDIT OF YUCCA MOUNTAIN SITE CHARACTERIZATION OFFICE**

During the week of August 6-10, 2001, the OR observed the DOE Quality Assurance (QA) audit of the Yucca Mountain Site Characterization Office in Las Vegas, NV. This was a compliance-based audit to determine whether the requirements of the Quality Assurance Requirements and Description document and associated implementing procedures were being met. The results of the audit identified six Deficiency Reports (DR's) and an NRC Open Item 01-01 that is related to the absence of a position description.

#### **SUPPLIER AUDIT/SURVEY REPORTS**

OR review of selected supplier audit/survey reports indicated three required additional clarification. These were discussed with DOE QA representative and Bechtel SAIC LLC (BSC) QA Manager. The BSC QA Manager indicated that when BSC assumed control of the supplier audit/survey functions, the BSC QA Manager reviewed the way that business had been done in the past. Since that time, he has directed his Procurement Quality Manager to establish new and more strict controls over the supplier audit/survey and their reporting processes.

#### **OBSERVATION OF THE DOE AUDIT OF BECHTEL SAIC COMPANY, LLC**

During the week of August 20, through 24, 2001, DWM staff, including the OR's, observed the DOE's audit of Bechtel SAIC Company (BSC), LLC, in Las Vegas, Nevada. DOE's audit team evaluated BSC's processes and activities that support the TSPA for the Site Recommendation (SR) technical report. DOE's audit team identified one potential deficiency in the area of software and one potential deficiency in the area of traceability/transparency. The DWM staff reviewed DOE's audit team findings and agreed with the result.

## **OUTREACH ACTIVITIES**

### **DOE ANNOUNCES AVAILABILITY OF YUCCA MOUNTAIN PRELIMINARY SITE SUITABILITY EVALUATION DOCUMENT AND SCHEDULE FOR SITE RECOMMENDATION CONSIDERATION HEARINGS**

On August 21, 2001, the DOE's Office of Civilian Radioactive Waste Management announced the release of the Yucca Mountain Preliminary Site Suitability Evaluation report. Public hearings in Nevada are scheduled for September 5, 2001 in Las Vegas, and in Amargosa Valley and Pahrump in mid October, 2001.

## **EXPLORATORY STUDIES FACILITY (ESF) & NRC KEY TECHNICAL ISSUES (KTIs)**

### **Seepage Testing**

DOE has completed moisture monitoring and testing in Alcoves 1, 2, 6, and Niches 1, 2. Limited moisture monitoring and seepage testing continues at Alcoves 3, 4, 7 and Niches 3 and 4.

### **CI-36 Validation Study**

Testing to determine the presence of bomb pulse chlorine-36 in the vicinity of the Sundance and Drill Hole Wash Faults is continuing. As reported by DOE the preliminary analysis of tritium and chlorine-36 have not confirmed the presence of bomb pulse chlorine-36; however, additional analysis is in progress. DOE scientists have established a standard protocol which will be used to analyze the remaining chlorine-36 validation samples. The sample management facility has completed crushing of the remaining samples which will be leached and the sample splits will be sent to the participating laboratories for analysis.

### **Thermal Testing**

DOE continues to maintain drift wall-rock temperatures below 200° Centigrade (392° Fahrenheit). DOE plans to hold these wall-rock temperatures through the end of the year to evaluate the effect of sustained heating on the hydrologic, chemical and mechanical behavior of the rock. On August 15, 2001, sensors in the heated drift recorded the following preliminary temperatures: canister temperature of 200° Centigrade (392° Fahrenheit), rock-mass surface temperature of 197.2° Centigrade (387° Fahrenheit), and air temperature of 201.7° Centigrade (395° Fahrenheit).

DOE scientists continue to monitor moisture and rock mass changes around the Heated Drift via geophysical logging of selected boreholes. DOE scientists also examined and quantified heat loss through the bulkhead as part of a scoping study.

### **Fluid Inclusion Study**

The final report from the University of Nevada Las Vegas (UNLV) has been delayed. This report is presently expected to be submitted to DOE by the end of FY2001.

### **Surface-Based Testing**

DOE has completed the field work supporting the geotechnical investigation of the Yucca Mountain North Portal area. Final reports are anticipated to be submitted to DOE by the end of FY 2001.

**Nye County Early Warning Drilling Program**

During this reporting period injection boreholes EWDP-1M1 and 1M2 were drilled and samples were collected. Reaming of these boreholes for the installation of casing and well screen is now in progress.

**Busted Butte Unsaturated Zone Transport Test Facility**

DOE completed post-test characterization of Phase II tracer testing and this site was closed. The completed work activities (e.g. overcoring selected injection boreholes, partial mine-back of the test block, and rock sampling and analyses), was done to better characterize the distribution of reactive and nonreactive tracers. Prior to site closure, DOE completed the partial mine-back and sampling of the Phase II block. Atomic Energy of Canada, LTD., continues radionuclide transport testing on blocks of rock extracted from the Busted Butte Test Facility.

**Engineered Barrier System (EBS) Testing**

DOE continued EBS testing at their Pilot Scale Test Facility located in North Las Vegas. To date 9 of the 14 Phase II tests have been completed. This phase of testing simulates the ability of the ventilation system to maintain sub-boiling temperatures at the emplacement drift wall in the potential repository.

## REPORT DETAILS

### 2.0 INTRODUCTION

The principal purpose of the OR report is to inform NRC staff, managers, and contractor's of information on the DOE programs for site characterization, repository design, performance assessment, and environmental studies that may be of use in fulfilling NRC's role during pre-licensing consultation. The principal focus of this and future OR reports will be on DOE's programs for the ESF, surface-based testing, performance assessment, data management systems, and environmental studies. Relevant information includes new technical data, DOE's plans and schedules, and the status of activities to pursue site suitability. The OR's also participate in activities associated with resolving NRC Key Technical Issues (KTI's). In addition to communication of this information, this report may raise potential licensing concerns, or express opinions; these items represent the views of the OR's. The reporting period for this report covers July1, 2001 through August 31, 2001.

### 3.0 OBJECTIVES

The OR mission is to principally serve as a point of prompt informational exchange and consultation and to preliminarily identify concerns about site investigations relating to potential licensing issues. The OR's accomplish this function by communicating, consulting and identifying concerns. Communication is accomplished by exchanging information on data, plans, schedules, documents, activities and pending actions, and resolution of issues. The OR's consult with DOE scientists, engineers, and managers with input from NRC Headquarters management on NRC policy, philosophy, and regulations. The OR's focus on such issues as Quality Assurance (QA), design controls, data management systems, performance assessment, and KTI's resolution. A principal OR role is to identify areas in site characterization and related studies, activities, or procedures that may be of interest or concern to the NRC staff.

### 4.0 QUALITY ASSURANCE, ENGINEERING, AND NRC KEY TECHNICAL ISSUES

#### **Deficiencies Data Base**

##### ***Background***

In the previous OR Report, the OR had reviewed the DOE data base used for tracking and trending the deficiencies adverse to quality that have surfaced during the various audits, surveillances, self assessments, or observations. These deficiencies have been documented in CAR's or in DR's which indicate where there may be repetitive recurrences of deficiencies that were previously identified and closed. One area where there appeared to be a trend pertained to deficiencies in developing and maintaining S/N.

There were several recurrences of various S/N deficiencies. Increased S/N deficiencies were noted as NRC OR Open Item 98-2 in the January-February 1998 NRC OR Report dated March 17, 1998. DOE initiated a custom training program for each participating organization in the use and control of S/N's. Also, reviews of 656 ongoing or open S/N's were conducted. Based on these results, the problems with S/N's were corrected and NRC Open Item 98-2 was closed in the October-December 1999 OR Report. Until recently these efforts appeared to be effective. However, several recurrences of S/N deficiencies again surfaced. A STIR was initiated by DOE on March 6, 2001, to determine whether sufficient actions are being taken by the affected organizations to correct recent conditions adverse to quality relative to implementation and use of S/N's. This resulted in DOE Surveillance Report BSC-SR-01-014 concluding "... BSC's management is proactive in the control of S/N's and that no adverse quality trend exists nor did the review indicate a significant condition adverse to quality."

The OR agreed that the S/N deficiencies that surfaced were mostly of a minor nature. However, the OR does not agree with the DOE conclusion that a trend does not now exist. This is of special concern in that DOE undertook a significant effort to correct the previous trend.

#### ***Current Status***

OQA has initiated an effort to review the recent documented information pertaining to S/N deficiencies and concerns. This review is due for completion by the end of September 2001.

#### **DOE QA Audit of Yucca Mountain Site Characterization Office**

During the week of August 6-10, 2001, the OR observed the DOE QA audit of the DOE Yucca Mountain Site Characterization Office in Las Vegas, NV. The purpose of this audit was to evaluate the Office of Civilian Radioactive Waste Management implementation of the QA Program at the Yucca Mountain Site Characterization Office in Las Vegas, NV. The audit was to determine whether the requirements of the DOE/RW-0333P Quality Assurance Requirements and Description document and associated implementing procedures were being met. This activity was a routine compliance-based audit to verify implementation adequacy and to determine the effectiveness of the QA program. Areas audited included: Organizational Interfaces, Training, Self Assessments, Q-List Classification, Procurement, Procedure Preparation and Approval, Document Review and Control, Managing Conditions Adverse to Quality, and Records Control.

The Audit Team was well prepared, independent, thorough, and objective. During the Audit, the OR requested to review the position descriptions (PDs) for the Assistant and Deputy Assistant Managers of the Office of Project Execution, and the Compliance Management Specialist (CMS) from the Office of Project Execution. The "status cover sheets" for the Assistant and Deputy Assistant Managers PDs contained minor inconsistencies. These inconsistencies were brought to the attention of the Lead Auditor. The PD for the Compliance Management Specialist (CMS) could not be retrieved, and therefore was not reviewed. It was explained to the OR that this PD had

been sent to Washington, DC, for review and revision. However, while the revision is needed, it has not been timely because the current CMS has held this position since 1999. This will be carried as NRC Open Item 01-01 in the OR Report until this PD can be produced for OR review.

The results of this audit identified six DR's and one deficiency corrected during the audit. The six DR's were in addition to four DR's issued as a result of an earlier DOE self assessment. At the audit exit, the OR's expressed their concern with the number of findings. It is recognized that the individual issues identified in these DR's are not significant. However, the OR emphasized that for rather straightforward and uncomplicated procedures, these were recurring implementation issues involving: (1) failure to follow procedures; (2) inattention to detail; and (3) management failure to properly convey expectations concerning quality-related activities. These recurring deficiencies are similar to previously identified deficiencies described in Corrective Action Requests (CARs) BSC-01-C-001 and BSC-01-C-002. This matter will be discussed in the QA/Management meetings scheduled for September 6-7, 2001.

### **Supplier Audit/Survey Reports**

The OR review of selected audit and survey reports of DOE suppliers indicated some of the reports listed below require additional clarification:

1. In the August 9, 2001, letter from D. Krisha to R. Gill for the survey of McDermott Technology, Inc. (MTI), the Executive Summary states, "MTI does not have the capability to perform Nondestructive Examination (NDE) activities but will subcontract any NDE activities to a supplier on the OCRWM Qualified Supplier's List (QSL)." Section 5.0 also states "MTI does not qualify suppliers of quality-affecting activities or items and has agreed to use suppliers on the OCRWM QSL." However, a review of the Supplier Evaluation Report reveals there are "no restrictions" imposed on MTI. The Executive Summary also states, "An evaluation of MTI's QA program for implementation and effectiveness of welding Alloy-22 was not possible, since MTI has not welded these materials in the past." In the Summary of Audit Results section of the report, the above statement appears to be contradicted with the statement, "MTI personnel are highly trained and skilled and have the required welding, inspection, and fabrication knowledge to perform the services required for the Yucca Mountain Site Characterization Project." The report should, but does not, describe the method/qualification process for MTI personnel to provide the welding of Alloy-22 material.
2. In the August 20, 2001, letter from D. Krisha to M. Peters of Bechtel SAIC for the verification of corrective action for the Deficiency Report issued to Ultra Scientific Inc., block 14 states that there is no impact as a result of the deficiency. Block 15 repeats the "no impact" statement and adds that the work was done correctly but not documented in accordance with the Ultra QA program. It is not clear why this deficiency had no impact on the Yucca Mountain Project. Also, there is no description to explain that if the work was not documented in accordance with the QA program, what the basis is for determining the work to be acceptable.

3. In an August 30, 2001, letter from D. Krishna to M. Peters of Bechtel SAIC regarding the verification of corrective action for the DR issued to Schlumberger Well Services, Block 15 recommended an internal audit be performed using qualified independent personnel. The last page of this letter for the verification and closure of this deficiency indicates that the documentation of the auditor to perform this audit was reviewed. Part of the basis for accepting this individual as a qualified auditor was that he attended the Arthur D. Little Inc. auditor training course. It is not clear whether the Arthur D. Little Inc. course issued a certification and for what type of auditing the individual was qualified to perform. In blocks 14 and 17, it is noted that an audit is recommended. On the last page of this letter, by virtue of the final signature, it indicates verification was performed without the recommended audit being performed.

The reports were discussed with a DOE QA representative and the Bechtel SAIC LLC (BSC) QA Manager. The BSC QA Manager indicated that when BSC assumed control of the supplier audit/survey functions, the BSC QA Manager reviewed the way that business had been done in the past. Since that time, he has directed his Procurement Quality Manager to establish new and more strict controls over the supplier audit/survey and their reporting processes.

One of the most recent directives is for the Procurement Quality Manager to personally review all of the vendor audit and survey reports and associated documentation, before they are presented to the BSC QA Manager for signature. Another initiative is to determine if re-audits, re-surveys, or surveillances are necessary, (because of the severity and/or number of deficiencies identified during the audit or survey), prior to allowing any future procurement actions by the Project. Also, the QA Manager is discussing ways to further define the capabilities of each vendor for the specific areas for which they are qualified and provide that information to the Qualified Suppliers List database. This will help potential purchasers to more aptly identify what vendor they can use for what specific service(s). The OR will follow-up on these proposed/potential changes.

#### **Observation of the DOE Audit of Bechtel SAIC Company, LLC**

During the week of August 20, through 24, 2001, DWM staff, including the OR's observed the DOE's audit of BSC, LLC, in Las Vegas, Nevada. DOE's audit team evaluated BSC's processes and activities that support the TSPA for the Site Recommendation (SR) technical report. The audit team evaluated the quality of the report by examining the development/analyses of scenarios; traceability/transparency of assumptions, uncertainties, and alternative conceptual models; data and other input; and software control. The audit team also assessed the defensibility of the TSPA-SR results/conclusions and evaluated the overall effectiveness of the TSPA-SR technical report. DOE's audit team identified one potential deficiency in the area of software and one potential deficiency in the area of traceability/transparency. The DWM staff reviewed DOE's audit team findings and agreed with the results, as presented at the post-audit briefing to DOE management. The DWM staff determined that this DOE

audit was well planned and that it adequately evaluated the BSC's activities supporting TSPA-SR.

## **5.0 OUTREACH ACTIVITIES**

### **DOE Announces Availability of Yucca Mountain Preliminary Site Suitability Evaluation Document and Schedule for Site Recommendation Consideration Hearings**

On August 21, 2001, the DOE's Office of Civilian Radioactive Waste Management announced the release of the Yucca Mountain Preliminary Site Suitability Evaluation report. This report provides an initial assessment of the site's performance against the radiation safety standards set by the Environmental Protection Agency (EPA) that were finalized in June of 2001. Those standards establish an annual dose rate to individuals beyond 11 miles of the site boundary to be no more than 15 millirem from all pathways exposure through air, water, soil and the food chain. The EPA also set a 4 millirem per year standard for radiation measured in groundwater that would be used for crops and dairy cattle over the 10,000-year regulatory period.

The Yucca Mountain Preliminary Site Suitability Evaluation provides additional information that is intended to facilitate public review and comment on a possible site recommendation by the Secretary of Energy to the President for development of a spent nuclear fuel and high-level nuclear waste geologic repository. Public hearings in Nevada are scheduled for September 5, 2001, in Las Vegas, and in Armagosa Valley and Pahrump in mid October, 2001. The OR's anticipate attending these hearings and the results of these public interactions will be documented in a future OR Report.

## **6.0 EXPLORATORY STUDIES FACILITIES (ESF), AND NRC KEY TECHNICAL ISSUES**

### **ENHANCED CHARACTERIZATION of the REPOSITORY BLOCK (ECRB)**

The excavation of the ECRB, completed on October 13, 1998, allows the collection of scientific and engineering data in stratigraphic units that constitute the bulk of the potential repository horizon. DOE continues ECRB construction and testing activities to maximize the amount of data available to support DOE TSPA - Site Recommendation. Enclosure 2 provides a description of the ESF and ECRB test locations. ECRB construction and testing activities are summarized below.

#### **Passive Hydrologic Test**

##### ***Background:***

Since June 1999, sections of the ECRB have been isolated from the rest of the underground facility by the construction of sealed bulkheads. These bulkheads are located at Stations 17+63, 25+03 and 26+00. No forced ventilation occurs beyond the bulkheads, except during brief entries to collect data and perform maintenance. This is a passive test designed to allow the isolated parts of the ECRB to return to ambient (pre-construction) moisture and temperature conditions to determine if dripping from the rock-mass can be observed. Hundreds of moisture monitoring probes are installed in tunnel walls at depths of up to 2 meters. While some test probes show evidence of

rewetting, DOE scientists have indicated that moisture conditions in this section of the ECRB have not fully re-equilibrated. DOE plans to continue this test through FY2001.

***Current Status:***

The September/October 2000 OR Report, initially suggested that DOE consider developing a detailed plan describing the test purpose and objective, approach, pre-test predictions, schedule and use of data collected. Such a plan would provide greater confidence that test results would address data needs for DOE-NRC issue resolution activities. DOE has completed development of a plan for this test that provides this information. DOE is also developing a procedure to enhance the documentation and transparency for future scientific and engineering testing. The procedure is intended to impose controls for documenting test requirements, pre-test predictions, and other relevant information in advance of future testing. This procedure is expected to be issued in the September 2001 time frame and the test plan will be issued under the provisions of the new procedure. The OR's will continue to monitor the development of this information and document the results in a future report.

The drift will be open for a long period of time so that the bulkhead can be moved and various enhancements to the test can be implemented. Enhancements will include remote camera and additional moisture collection devices. The next planned opening of these bulkheads is scheduled for the first or second week of October 2001.

**Niche #5**

***Background:***

This niche is constructed at Station 16+20 to conduct seepage testing in the Topopah Spring lower lithophysal zone. Over two-thirds of the potential repository is planned to be located in this rock unit. Niche walls and boreholes have been instrumented with moisture monitoring equipment. DOE also completed the construction of a "batwing" on the left of Niche 5. This batwing is designed to enhance DOE's ability to monitor and collect any moisture moving around this niche. Test results will support the unsaturated zone flow and transport process model report.

***Current Status:***

Air-K testing and ground penetrating radar testing were completed during this reporting period. Infiltration testing is planned to resume in late August or early September 2001. Seepage testing in Niche 5 is expected to continue through FY2001.

**Systematic Hydrologic Characterization (SHC)**

***Background:***

DOE scientists are conducting SHC testing to investigate the spatial variability of hydrologic properties affecting seepage processes. DOE plans to drill approximately 20 boreholes in the Topopah Spring lower lithophysal zone. These boreholes will be used for air permeability and liquid release/seepage measurements along with gas tracer measurements. Test results will feed the near-field and unsaturated zone flow and transport process model reports.

***Current Status:***

During this reporting period, DOE continued to conduct SHC testing in a series of 20 meter deep boreholes in the Topopah Spring lower lithophysal zone. Testing has been completed in the arrays at Station 16+95. DOE is currently preparing for testing at station 16+65 meters. Plans are also in place to complete more systematic boreholes by the end of FY01. DOE anticipates continued testing through FY2001.

**In-Situ Thermal Conductivity Measurements*****Background:***

DOE's thermal properties data of the Topopah Spring lower lithophysal tuff unit is limited to a small number of laboratory measurements. Therefore, DOE plans to collect in-situ thermal conductivity measurements by drilling a series of 8.5 meter deep boreholes in this rock unit. Each set of boreholes will contain a heater hole along with one or more observation holes containing temperature sensors. The thermal pulse measured from the heater will allow the in-situ thermal conductivity of the rock to be calculated.

***Status:***

DOE completed drilling the third set of thermal conductivity boreholes scheduled for FY2001. The completed sets of boreholes are located near Stations 15+43, 15+65 and 17+45. Thermal conductivity boreholes at Station 15+65 are instrumented and collecting data. As reported by DOE, testing was performed on a low power setting until the week of July 20, 2001, and then continued on high power setting (3KW). Heater temperatures of 344°F were reported in mid August. This testing will continue through FY2001.

**Alcove 8:*****Background:***

This alcove is constructed at Station 8+00 to conduct seepage testing from the Topopah Spring upper lithophysal zone to the underlying Topopah Spring middle nonlithophysal zone. DOE completed drilling a series of boreholes downward from this alcove for moisture monitoring. Niche #3, previously constructed in the Topopah Spring middle nonlithophysal zone, is situated 20 meters directly below this alcove and will be used in this test. Infiltration systems constructed on the floor of Alcove 8 will apply traced water at a measured rate. Boreholes in Alcove 8 and Niche #3 will be used to monitor changes in moisture content and other properties of the rock-mass. DOE scientists plan on monitoring these boreholes using ground penetrating radar, neutron logging, and acoustic tomography. Test results will feed near field and unsaturated zone flow and transport process model reports.

Two infiltration plots have been constructed on the floor of this alcove. One plot measured approximately 1 X 1 meter, and the second plot approximately 3 X 4 meters. The 1 X 1 meter plot was constructed on a segment of a small fault exposed both on the floor of Alcove 8 and the roof of Niche 3. From August to December 2000, DOE scientists ponded water on this fault and monitored moisture conditions in Niche 3 to determine the breakthrough time of traced water, but no breakthrough occurred. According to DOE scientists, this fault is filled with gouge (clay like material) which may be inhibiting flow. DOE scientists report that subsequent analyses of this gouge

material indicate the presence of smectite (clay that swells with water). To enhance infiltration and seepage processes along this fault, DOE scientists enlarged the infiltration plot. A trench (roughly 15 centimeters deep, 40 centimeters wide, and 4 meters long) was constructed along this fault. This trench allows water to pond over the entire length of the fault exposed in the floor of Alcove 8. On March 6, 2001, DOE started infiltration on this trench, and on April 6th, DOE scientists detected initial breakthrough of traced water in Niche #3.

***Current Status:***

As reported by DOE, the current infiltration rate on the trench in Alcove 8 is approximately 9.0 liters per hour, and the seepage rate in Niche #3 is roughly 5 percent of the infiltration rate. DOE has deferred the start of infiltration on the 3 X 4 meter plot until testing on this fault is completed. Seepage testing on this fault continued through this reporting period and is expected to continue through FY2001.

**EXPLORATORY STUDIES FACILITY (ESF) TESTING**

**Seepage Testing**

DOE has completed moisture monitoring and testing in Alcoves 1, 2, 6, and Niches 1, 2. Limited moisture monitoring and seepage testing continues at Alcoves 3, 4, 7 and Niches 3 and 4. Ongoing ESF testing activities are summarized below.

**CI-36 Validation Study**

***Background:***

DOE scientists are proceeding with a study to validate the presence of bomb-pulse chlorine-36 at two locations in the ESF. Approximately 60 samples have been collected in the vicinity of the Drill Hole Wash Fault and the Sundance Fault where elevated concentrations of chlorine-36 were detected in a previous study. These samples are being analyzed for chlorine-36, tritium, technetium-99, and supplemented by analyses of uranium, thorium, iodide-129 and radium isotopes.

To date, this validation study has detected no elevated chlorine-36 values; however, additional samples await analyses. According to DOE scientists, one possible explanation for the apparent disagreement between results of this study and an earlier study may lie in sample preparation and processing techniques. One of the two laboratories involved is thought to have used a more aggressive crushing technique and longer leach times which may release more rock chloride thus reducing the ratio of chlorine-36 to chlorine. To determine the effect of two different sample preparation and processing techniques, a bulk sample has been collected from the ECRB, crushed to a uniform size, and sample splits shipped to the two laboratories for analyses. According to DOE, the results of these analyses will be compared and the two laboratories will then agree to a standard sample processing method for subsequent chlorine-36 analyses. The two laboratories will synthesize their results and prepare a report documenting their findings including implications for conceptual models of unsaturated zone flow and transport. An interim report is expected to be completed by the end of CY2001. The two laboratories completed separate leaching experiments of reference sample splits to determine what effect different leaching procedures have on the release of rock chloride and chlorine-36 analyses. According to DOE, preliminary results indicate that chlorine-36 analyses are sensitive to the sample leaching time.

These results suggest that minimal sample treatment (e.g., passive leaching and reduced leaching time) yields higher ratios of chlorine-36 to chlorine. Based on these results, the DOE laboratories have agreed on the protocol for chlorine-36 analyses and will use a 24 hour or shorter passive leach technique, and require that the Sample Management Facility crush all samples to a uniform size for leaching.

***Current Status:***

DOE scientists have established a standard protocol which will be used to analyze the remaining chlorine-36 validation samples. The sample management facility has completed crushing of 12 samples and USGS is currently leaching the sample splits which will be sent to the labs for analysis.

**Alcove 5 (Thermal Testing Facility Access/Observation Drift, Connecting Drift, and Heated Drift)**

***Background:***

DOE initiated the heating phase of this test on December 3, 1997. The four-year heat-up phase will be followed by a four-year cool-down phase. Heat generated by nine electrical floor heaters and 50 electrical wing heaters simulate heat from emplaced waste. This test is designed to heat approximately 15,000 cubic meters of rock in the proposed repository horizon to 100° Centigrade (212° Fahrenheit) or greater to investigate coupled thermal-hydrologic-mechanical-chemical processes. These processes are monitored by approximately four thousand sensors positioned in 147 boreholes around the heated drift. A data collection system records measurements from these sensors.

***Current Status:***

DOE continues to maintain drift wall-rock temperatures below 200° Centigrade (392° Fahrenheit). DOE plans to hold these wall-rock temperatures through CY2001 to evaluate the effect of sustained heating on the hydrologic, chemical and mechanical behavior of the rock. On August 15, 2001, sensors in the heated drift recorded the following preliminary temperatures: canister temperature of 200° Centigrade (392° Fahrenheit), rock-mass surface temperature of 197.2° Centigrade (387° Fahrenheit), and air temperature of 201.7° Centigrade (395° Fahrenheit).

DOE scientists continue to monitor moisture and rock mass changes around the Heated Drift via geophysical logging of selected boreholes. DOE is also monitoring rock mass changes inside the Heated Drift. Furthermore, as indicated in a recent scoping study, DOE scientists have examined and quantified heat loss through the bulkhead.

**Fluid Inclusion Study**

***Background:***

UNLV scientists have completed a study to determine the origin and age of fluid inclusions found in secondary minerals (calcite and silica) at Yucca Mountain. Over 150 samples from the ESF and ECRB have been collected and characterized to better understand the development of secondary minerals and spatial distribution of fluid inclusions.

***Current Status:***

As reported by DOE, UNLV's final report has been delayed. This report is expected to be submitted to DOE by the end of FY2001.

**Laser Strainmeter Test*****Background:***

Under a cooperative agreement with the Yucca Mountain Site Characterization Office, the University of California, San Diego will install and monitor a long-baseline strainmeter (LSM) in the ESF. The LSM experiment will supplement Global Positioning System surveys conducted at five sites in the Yucca Mountain area from 1991 to 1997, which indicated higher crustal elongation rates (strain rates) than those indicated by the volcanic and tectonic history of the region. The general test description consists of the installation and operation of the LSM along the South Ramp of the ESF. A laser will measure the distance between two end monuments.

***Current Status:***

DOE completed construction of strainmeter niche monuments. Construction and installation of the remaining instrument enclosure, electrical and sheetmetal is continuing. The LSM is presently expected to be operational by the end of FY2001, or in early FY2002.

**SURFACE-BASED TESTING****Alluvial Tracer Complex (ATC)*****Background:***

The ATC is a joint Nye County and DOE Cooperative Program to investigate flow and transport properties of the saturated alluvium. Single-well ATC testing is being conducted at well NC-EWDP-19D/D1 (Enclosure 3) and includes both hydrologic and tracer testing. Cross-well hydrologic and tracer testing will also be performed at NC-EWDP-19D/D1 following the completion of single-well activities. Nye County drilled 19D/D1 to a depth of 1438 feet and encountered water at 366 feet and volcanic rocks at 810 feet. This well was completed to isolate six water bearing zones (4 in alluvium and 2 in volcanic rocks). Nye County instrumented wells NC-EWDP-4PA, 4PB, 19P, 15P and Washburn to determine the affects of ATC hydrologic testing on surrounding wells. Nye County plans to drill up to 4 additional wells, to a depth of 800-1000 feet, for cross-hole testing at this location.

***Current Status:***

As reported by DOE, drilling of injection/monitoring well boreholes EWDP-IM1 and IM2 was completed and samples have been collected. Reaming of these boreholes for installation of casing and well screen is now in progress. Enclosure 4 provides the well configuration for cross-hole testing.

**Waste Handling Building Geotechnical Investigation*****Background:***

DOE is conducting a geotechnical investigation at the Yucca Mountain North Portal area to collect data for the design of a waste handling building for a potential

repository. This activity involved drilling a series of boreholes and excavating trenches/test pits to characterize this area. The field work is completed.

***Current Status:***

DOE continued the work of integrating geotechnical information collected from drilling and geophysical logging of 15 shallow boreholes and four test pits. Final reports on these activities are expected to be submitted to DOE by the end of FY 2001.

**Characterization of Near Surface Velocity Structure**

***Background:***

DOE is collecting near surface velocity data at Yucca Mountain for use in the design of surface and subsurface facilities for a potential repository at Yucca Mountain.

***Current Status:***

As indicated by DOE they have completed the Spectral Analysis of Surface Waves (SASW) surveys to assess shear wave profiles of shallow rock units at Yucca Mountain. During the coming months, additional testing will attempt to extend the near surface velocity structure characterization to the potential repository horizon. DOE expects to complete this testing by the end of FY2001. Analysis modeling and documentation is expected to be completed in FY2002.

**Busted Butte Unsaturated Zone Transport Test**

***Background:***

The planned hydrologic and tracer testing at Busted Butte is designed to provide data to help model flow and transport of radionuclides in the unsaturated zone under the proposed repository. The Busted Butte underground facility includes a 72.5 meter main drift and a 19 meter test alcove. The test is fielded in the base of the Topopah Spring non-to-partly-welded vitric sub-zones and the top of the Calico Hills Formation. Phase I tracer testing was completed in 1998. Phase II tracer testing was conducted in a separate 10 X 10 X 6 meter block of rock and this testing was completed in December 2000.

***Current Status:***

DOE completed post-test characterization of Phase II tracer testing and the site was closed. The completed work activities (e.g., overcoring selected injection boreholes, partial mine-back of the test block, and rock sampling and analyses), was done to better characterize the distribution of reactive and nonreactive tracers. Prior to site closure, DOE completed the partial mine-back and sampling of the Phase II block. Atomic Energy of Canada, LTD., continues radionuclide transport testing on blocks of rock extracted from the Busted Butte Test Facility.

**ENGINEERED BARRIER SYSTEM (EBS) TESTING**

***Background:***

The Engineered Barrier System Operations (EBSO) Office of the Yucca Mountain Project continues to perform EBS testing. The EBS tests are performed in a Pilot Scale Test Facility located in North Las Vegas. Test results are used to support the EBS degradation and transport process model report.

**Current Status:**

DOE continued EBS testing at their Pilot Scale Test Facility. To date, 9 of the 14 Phase II tests are complete. This phase testing simulates the ability of the ventilation system to maintain sub-boiling temperatures at the emplacement drift wall in the potential repository.

**PILOT SCALE TESTING****Pre-closure Ventilation Test****Background:**

DOE's System Design Description for the emplacement drift system states that the subsurface ventilation will remove 70 percent of the heat generated by the waste packages during pre-closure. DOE is conducting a multi-phase pre-closure ventilation test in the EBS test facility. The objectives of this test are to (1) develop data to support the design of the ventilation system for the potential repository to maintain sub-boiling emplacement drift temperatures; and (2) provide data to support computer models used for ventilation calculations. This testing is expected to be completed by the end of FY2001.

**Current Status:**

Phase II EBS ventilation testing, which started in April 2001, continued over this period. To date, 9 of 14 Phase II tests have been completed. Phase II testing is expected to simulate the ability of the inlet air, at different temperatures, to maintain sub-boiling temperatures at the emplacement drift wall in a potential repository. DOE also completed a description of Phase III testing over this period.

**7.0 GENERAL****1.0 Appendix 7 Interactions**

None

**2.0 Technical Exchanges**

July 24 through 26, 2001, staff from the Division of Waste Management (DWM) including the OR's and representatives from the Center for Nuclear Waste Regulatory Analysis (CNWRA) met with members of the DOE during a technical exchange in Las Vegas, Nevada. The meeting focused on safety issues during repository operations and before permanent closure of the proposed repository at the Yucca mountain site. Because this was the first technical exchange on pre-closure safety, and acceptance criteria had not been provided to DOE, categorization of the status of issue resolution for the pre-closure topics will be considered at future meetings. DOE provided a general overview of the Integrated Safety Analysis Process. Other DOE presentations included: (1) preliminary identification; (2) identification of event sequences; (3) methodologies for calculating doses; (4) identifying and categorizing design detail appropriate for the different stages of a potential license application; (6) pre-closure design issue such as burn-up credit and criticality related to waste form; and (7) pre-closure design issues pertinent to the engineered barriers.

Based on these discussions, the NRC and DOE reached agreements pertaining to additional information DOE needed to provide.

On August 2, 2001 staff from the DWM and the DOE conducted a technical exchange in Rockville, Maryland. The OR's participated in selected aspects of this technical exchange via teleconference. During the technical exchange, DOE discussed the historical and current thermal management designs for the potential geological repository at Yucca Mountain, Nevada. DOE also presented an overview of the recently released Supplemental Science and Performance Analysis report. The report presents the results of an exploratory evaluation of the range of thermal operating modes, sensitivity and uncertainty analyses, and updated site models. The report provides insights into uncertainties that were not evaluated in DOE's prior performance assessments. This technical exchange provided a basis for the staff to begin a technical review of the report. The staff's comments on the report will be addressed during the planned September 18-19, 2001, "Range of Thermal Operating Modes" technical exchange and management meeting.

August 6 through 10, 2001, staff from the DWM including the OR's and representatives from the CNWRA participated in a technical exchange with the DOE. The purpose of the technical exchange was to discuss the status of the four subissues within the TSPA and Integration KTI. Resolution of the four subissues involved DOE addressing the NRC staff comments and questions in the areas of multiple barriers, scenario analysis, model abstraction, and the overall performance objective. After reaching a total of 58 separate agreements, the staff was able to classify the subissues pertaining to multiple barriers, scenario analysis, and the overall performance objective as closed-pending. The subissue on model abstraction remained open, because questions that were posed during an earlier technical exchange on the Igneous Activity Key Technical Issue remain open. Once these questions have been answered satisfactorily, the model abstraction subissue will be designated as closed-pending. The discussions on the multiple barrier and the overall performance objective subissues only addressed the methods used by DOE and other information that NRC would need to conduct a licensing review, and was not an evaluation of DOE's ability to meet the regulatory requirements in these areas. The meeting was observed by the U.S. Nuclear Waste Technical Review Board; Clark, Lincoln, Mineral, and NYE counties (Nevada); State of Nevada; Electric Power Research Institute; Nuclear Energy Institute; and the Nevada Nuclear Waste Task Force. In addition, during this meeting, preliminary agreements from an earlier technical exchange on features, events, and processes were made final, and modifications to agreements on the Unsaturated and Saturated Flow Under Isothermal Conditions KTI were agreed on.

### **3.0 Other**

#### **Site Visits**

July 23, 2001, five members from the Chinese National Nuclear Safety Administration, the NRC Executive Director for Operations, a member from the

NRC Office of International Programs, and the OR's visited the Yucca mountain Site. The purpose of this visit was to obtain an overview of the Exploratory Studies Facility and Yucca Mountain Crest.

There were no outstanding issues raised as a result of these visits.





